

REPORT  
COMPARISON OF BROADBAND RADIANCES FROM MSG-1 AND MSG-2  
FOR APPLICATION OF HELIOSAT-2 TO  
HELIOCLIM-2 AND -3

Heliosat-2 applies on broadband radiances. The radiances from the two channels of MSG are combined together to form a radiance that mimics that that should be observed by Meteosat-7 visible channel. The present report analyses the possible differences in radiances occurring when applying the transform to Meteosat-8 (MSG-1) or Meteosat-9 (MSG-2) data. Meteosat-9 replaces Meteosat-8 when the latter exhibits dysfunctioning.

Coincident images from Meteosat-8 and Meteosat-9 are available for several days in October and November 2006. Digital numbers are picked up for three to five pixels, randomly selected, in each image. They are converted into radiances by applying the calibration coefficients disseminated with the images by Eumetsat. These coefficients differ from one satellite to the other. Then, these radiances for each channel are converted into broadband radiances as explained in Cros et al. (2006). This transform is the same for both satellite: coefficients are similar. Then, the resulting broadband radiances for Meteosat-8 and -9 are compared. The study is made for images acquired at 12 h UT and 14 h UT separately.

Selected images.

<i>Month</i>	<i>Day</i>
October 2006	12, 20
November 2006	5, 20, 30

## Results

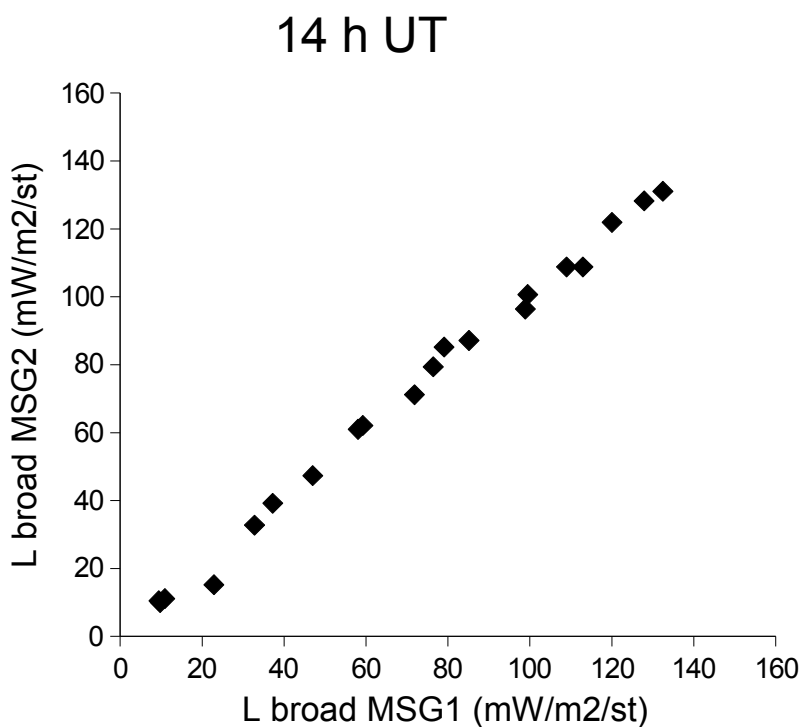
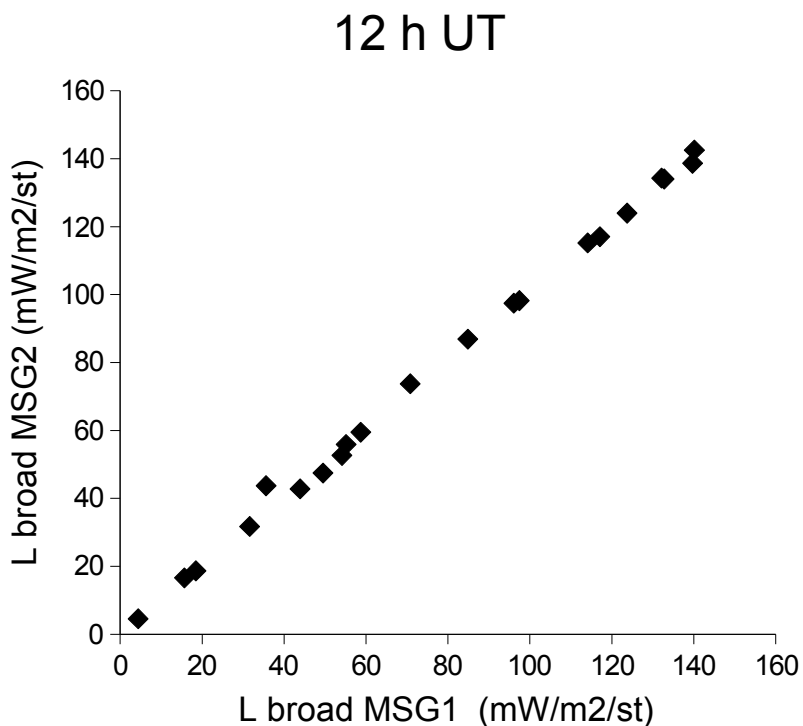
<i>Parameter</i>	<i>12 h UT</i>	<i>14 h UT</i>	<i>All mixed</i>
Number of samples	21	21	42
Mean value for M-8 (mW/m <sup>2</sup> /st)	76.96	66.76	71.86
Mean value for M-9 (mW/m <sup>2</sup> /st)	77.88	67.12	72.50
Bias (M9 – M8) (mW/m <sup>2</sup> /st)	0.92	0.35	0.64
Relative bias (%)	1.2	0.5	0.9
RMSD	2.23	2.78	2.52
Relative RMSD (%)	2.9	4.2	3.5
Correlation coefficient	0.999	0.998	0.998
Regression line. Slope	1.001	1.002	1.002
Regression line. Intercept	0.843	0.226	0.478

The bias is very small, the correlation coefficient is high, the RMSD is small. The slope of the regression line is very close to 1 and the the intercept is close to 0. This indicates that the broadband radiances are similar for both satellites, as shown in the following graphs.

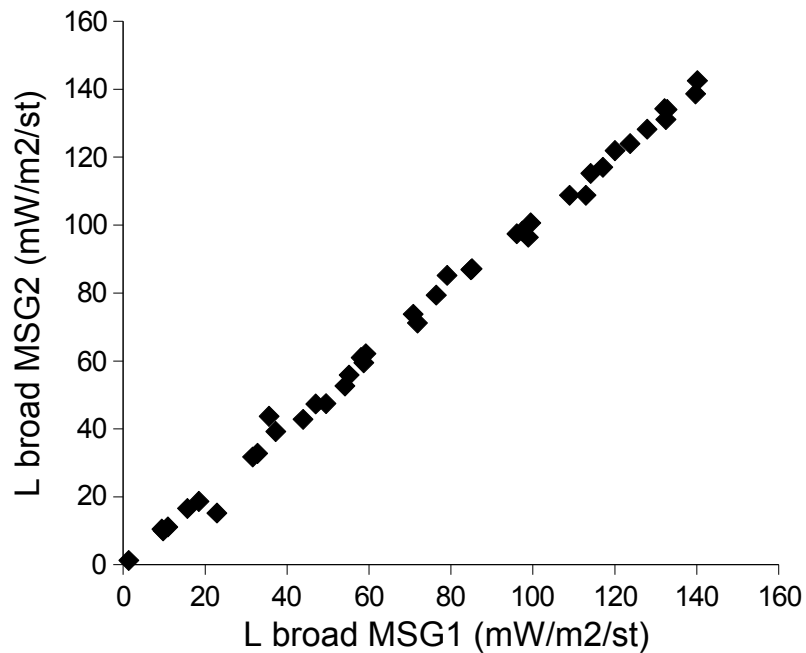
We found that discrepancies may occur sometimes for land areas in Africa, of low reflectances,

under clear skies. The cause is the difference in location of the satellites; accordingly, the viewing angle differ and this may lead to discrepancies in radiances. For these areas, it may happen that the irradiance under clear skies is larger with Meteosat-8 than with Meteosat-9. The exact discrepancy cannot be predicted as it is a complex function of the geometry of the sun and of the satellite relative to the pixel location, of the season, of the current ground and cloud albedos and their respective discrepancies with actual values. Nevertheless, these discrepancies are small and are less than 10%; this is less than the error made in using climatological values for optical properties of the clear atmosphere compared to what would be obtained using actual values.

## Graphs



## 12 h and 14 h UT



### Conclusion

There is no noticeable difference between the broadband radiances simulated from images of Meteosat-8 or -9. Consequently, the operational chain used to construct the database HelioClim-2 or HelioClim-3 may apply to each satellite indifferently. Changing from a satellite to another has no impact on the quality of the database provided the correct calibration coefficients are used.

### Reference

Cros S., Albuissou M., Wald L., 2006. Simulating Meteosat-7 broadband radiances at high temporal resolution using two visible channels of Meteosat-8. *Solar Energy*, 80, 3, 361-367, doi: 10.1016/j.solener.2005.01.012.